

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (original) An automated tool installation and workspace analysis method comprising:

calculating a center of gravity of a fastener;

determining an axis of the fastener based at least partially on the center of gravity; and

determining positioning of a fastener actuating tool according to the axis of the fastener.

2. (original) The method of claim 1 wherein determining the axis includes determining the axis based on a relationship between an initial axis and vertices of the fastener.

3. (original) The method of claim 1 wherein determining the axis includes:

assuming an initial axis;

rotating the initial axis; and

adjusting the initial axis based on a relationship between the initial axis and vertices of the fastener.

4. (original) The method of claim 3 wherein the assuming includes assuming an initial axis of $L(c, V)$, where c is the center of gravity of the fastener, V is $(1, 0, 0)$, and L is a line through c having direction V .

5. (original) The method of claim 3 wherein the rotating includes rotating the initial axis in at least one direction about at least one axis.

6. (original) The method of claim 4 wherein the relationship is a distance between each vertex and the line $L(c, V)$.

7. (original) The method of claim 1 further comprising rotating the tool about the axis to determine a tool-rotation envelope.

8. (original) A graphical user interface that implements the method of claim 1.

9. (original) An automated tool installation and workspace analysis method comprising:

determining geometry of a fastener in an environment;

calculating a center of gravity of the fastener; and

determining an axis of the fastener based at least partially on the geometry of the fastener and the center of gravity.

10. (original) The method of claim 9 wherein determining the geometry includes determining vertices of the fastener.

11. (original) The method of claim 10 wherein determining the axis includes:

assuming an initial axis of the fastener; and

adjusting the initial axis based on a relationship between an initial axis and vertices of the fastener.

12. (original) The method of claim 11 wherein the adjusting includes:

rotating the initial axis in at least one direction;

calculating an updated relationship between the rotated axis and the vertices of the fastener; and

adjusting the initial axis based on the updated relationship.

13. (original) The method of claim 11 wherein the assuming includes assuming an initial axis of $L(c, V)$, where c is the center of gravity of the fastener, V is a direction $(1, 0, 0)$, and L is a line through c having direction V .

14. (original) The method of claim 12 wherein the step of rotating includes rotating the initial axis in at least one direction about at least one of an x axis, a y axis, and a z axis.

15. (original) The method of claim 11 wherein the relationship is a distance between each vertex and the initial axis.

16. (new) An automated tool installation and workspace analysis method comprising:

calculating a center of gravity of a fastener;

determining an axis of the fastener based at least partially on the center of gravity and thereby determining a position for an actuating tool to actuate said fastener as a function of said axis of the fastener;

positioning said actuating tool according to said position and determining rotation of said actuating tool within the workspace; and

evaluating said actuating tool based on said rotation of said actuating tool and said position.

17. (new) The method of claim 16 wherein said actuating tool comprises a wrench that actuates said fastener by rotating so that said fastener fastens to the workspace.